

JOURNAL OF GEOPHYSICAL RESEARCH

The continuation of
TERRESTRIAL MAGNETISM AND ATMOSPHERIC ELECTRICITY
(1896-1948)
An International Quarterly

Founded 1896 by L. A. BAUER

Continued 1928-1948 by J. A. FLEMING

Editor: MERLE A. TUVE

Editorial Assistant: WALTER E. SCOTT

Associate Editors

N. Arley, Polarvej 12,
Hellerup, Denmark
J. Bartels, University of Göttingen,
Göttingen, Germany
H. G. Booker, Cornell University,
Ithaca, New York
B. C. Browne, Cambridge University,
Cambridge, England
S. Chapman, High Altitude Observatory,
Boulder, Colorado
A. A. Giesecke, Jr., Instituto Geofisico,
Huancayo, Peru
J. B. Hersey, Oceanographic Institution,
Woods Hole, Massachusetts

D. F. Martyn, Commonwealth Observatory,
Canberra, Australia
T. Nagata, Geophysical Inst., Tokyo Univ.,
Tokyo, Japan
M. Nicolet, Royal Meteorological Institute,
Uccle, Belgium
B. F. J. Schonland, Atomic Energy Research
Establishment, Harwell, England
M. S. Vallarta, C.I.C.I.C.,
Puente de Alvarado 71, Mexico, D. F.
J. T. Wilson, University of Toronto,
Toronto 5, Canada

VOLUME 62 FOR THE YEAR 1957

Part two of two parts, December, 1957

Published at

THE WILLIAM BYRD PRESS, INC.
P. O. Box 2-W, SHERWOOD AVE. AND DURHAM ST.
RICHMOND 5, VIRGINIA

Address all correspondence to

JOURNAL OF GEOPHYSICAL RESEARCH
5241 BROAD BRANCH ROAD, NORTHWEST
WASHINGTON 15, D.C., U.S.A.

SIX DOLLARS A YEAR

SINGLE NUMBERS, TWO DOLLARS

JOURNAL OF GEOPHYSICAL RESEARCH
The continuation of
Terrestrial Magnetism and Atmospheric Electricity
(1896-1948)
An International Quarterly

Fields of Interest

Terrestrial Magnetism
Atmospheric Electricity
The Ionosphere
Solar and Terrestrial Relationships
Aurora, Night Sky, and Zodiacal Light
The Ozone Layer
Meteorology of Highest Atmospheric Levels

The Constitution and Physical States of the
Upper Atmosphere
Special Investigations of the Earth's Crust
and Interior, including experimental seismic
waves, physics of the deep ocean and ocean
bottom, physics in geology
And similar topics

This Journal serves the interests of investigators concerned with terrestrial magnetism and electricity, the upper atmosphere, the earth's crust and interior by presenting papers of new analysis and interpretation or new experimental or observational approach, and contributions to international collaboration. It is not in a position to print, primarily for archive purposes, extensive tables of data from observations or surveys, the significance of which has not been analyzed.

Forward manuscripts to one of the Associate Editors, or to the editorial office of the Journal at 5241 Broad Branch Road, Northwest, Washington 15, D.C., U.S.A. It is preferred that manuscripts be submitted in English, but communications in French, German, Italian, or Spanish are also acceptable. A brief abstract, preferably in English, must accompany each manuscript. A publication charge of \$8 per page will be billed by the Editor to the institution which sponsors the work of any author; private individuals are not assessed page charges. Manuscripts from outside the United States are invited, and should not be withheld or delayed because of currency restrictions or other special difficulties relating to page charges. Costs of publication are roughly twice the total income from page charges and subscriptions, and are met by subsidies from the Carnegie Institution of Washington and international and private sources.

Back issues and reprints are handled by the Editorial Office, 5241 Broad Branch Road, N.W., Washington 15, D.C., U.S.A.

Subscriptions are handled by the Editorial Office, 5241 Broad Branch Road, N.W., Washington 15, D.C., U.S.A.

Second-class mail privileges authorized at Richmond, Va.

TABLE OF CONTENTS

MARCH, 1957

A STATISTICAL ANALYSIS OF MAGNETIC PROFILES, - <i>P. H. Serson and W. L. W. Hannaford</i>	1
LINEAR SECULAR OSCILLATION OF THE NORTHERN MAGNETIC POLE, - - - - <i>E. R. Hope</i>	19
ROTATION, PULSE-DISTURBANCE, AND DRIFT IN THE GEOMAGNETIC SECULAR VARIATION, <i>E. R. Hope</i>	29
CALCULATIONS OF IONOSPHERIC REFLECTION COEFFICIENTS AT VERY LOW RADIO FREQUENCIES, - - - - - <i>James R. Wait and Loris B. Perry</i>	43
UPPER AIR PRESSURE AND DENSITY MEASUREMENTS FROM 90 TO 220 KILOMETERS WITH THE VIKING 7 ROCKET, - - - - - <i>R. Horowitz and H. E. LaGow</i>	57
METEOR ECHOES AT ULTRA-HIGH FREQUENCIES, - - - - - <i>Walter A. Flood</i>	79
RADIO FREQUENCY AND SCATTERING ANGLE DEPENDENCE OF IONOSPHERIC SCATTER PROPAGATION AT VHF, - - - - - <i>Albert D. Wheelon</i>	93
SEISMIC EXPLORATION OF THE CONTINENTAL SHELF OFF THE WEST COAST OF INDIA, <i>J. N. Nanda</i>	113
PENETRATION OF THE GEOMAGNETIC SECULAR FIELD THROUGH A MANTLE WITH VARIABLE CONDUCTIVITY, - - - - - <i>Keith Leon McDonald</i>	117
NOTE ON INDUCTION DRAG, - - - - - <i>K. P. Chopra</i>	143
THE SUPERPOSITION OF COSMIC-RAY EFFECTS ON FEBRUARY 23, 1956, - - <i>Robert R. Brown</i>	147
GEOMAGNETIC AND SOLAR DATA: International Data on Magnetic Disturbances, Part 1, Sudden Commencements and Solar-Flare Effects, Second Quarter, 1956, <i>A. Romañá</i> , and Part 2, <i>Kp</i> , <i>Ap</i> , <i>Ci</i> , and Selected Days, Third Quarter, 1956, <i>J. Bartels and J. Veldkamp</i> ; Provisional Sunspot-Numbers for October to December, 1956, <i>M. Waldmeier</i> ; Fredericksburg Three-Hour-Range Indices <i>K</i> for October to December, 1956, <i>Robert L. Gebhardt</i> ; Principal Magnetic Storms, - - - - -	155
LETTERS TO EDITOR: On Sudden Commencements of Magnetic Storms at Higher Latitudes, <i>S. Matsushita</i> ; Comments Concerning the <i>J. E. Hill</i> and <i>J. J. Gilvarry</i> Article, "Application of the Baldwin Crater Relation to the Scaling of Explosion Craters," <i>C. S. Beals</i> ; Regarding the <i>J. H. Meek</i> Article, "A Method for Drawing the Great-Circle Path between Any Two Points on Earth," <i>J. H. Meek</i> ; Erratum in Article, "Physical Properties of the Atmosphere from 90 to 300 Kilometers," <i>H. K. Kallmann, W. B. White, and H. E. Newell, Jr.</i> ; Large Increase of Cosmic-Ray Intensity Following Solar Flare on February 23, 1956, <i>Scott E. Forbush</i> ; Emission from Sodium Vapor Ejected into the Earth's Atmosphere at Night, <i>John F. Bedinger and Edward Manring</i> , - - - - -	162
NOTES: IGY observations of the ionosphere; Centenary of the birth of Sir <i>J. J. Thomson</i> ; Announcement of Committee on Extension to the Standard Atmosphere; Thirty-eighth annual meeting of the American Geophysical Union; Eleventh General Assembly of the International Union of Geodesy and Geophysics; Symposium on Systems for Information Retrieval; Sesquicentennial of the United States Coast and Geodetic Survey; Geomagnetic activities of the United States Coast and Geodetic Survey; New section of sun-earth relationships, Boulder Laboratories, National Bureau of Standards; Spring meeting of URSI; Twelfth General Assembly of URSI; Personalia; Corrigendum, - - - - -	172
LIST OF RECENT PUBLICATIONS, - - - - - <i>W. E. Scott</i>	175

DRIFT MEASUREMENTS OF THE E-LAYER, - - - - -	<i>L. Harang and K. Pedersen</i>	183
AN OBSERVATION OF AUDIO-FREQUENCY ELECTROMAGNETIC NOISE DURING A PERIOD OF SOLAR DISTURBANCE, - - - - -	<i>J. M. Watts</i>	199
CONSIDERATIONS REGARDING THE SODIUM LINES IN THE NIGHTGLOW AND TWILIGHT, - - - - -	<i>A. Omholt</i>	207
A NOMOGRAM FOR SOLVING SPHERICAL TRIANGLES AND TRANSFORMING ASTRONOMICAL COORDINATE SYSTEMS, - - - - -		
<i>Pierre St. Amand, F. K. Odencrantz, Helen B. Pettit, and R. G. Weldon</i>		213
THE VERTICAL FLUX OF ATMOSPHERIC OZONE, - - - - -	<i>Victor H. Regener</i>	221
COSMIC RADIO-NOISE INTENSITIES BELOW 10 Mc/s, - - - - -	<i>G. R. Ellis</i>	229
VARIATIONS IN THE GEOMAGNETIC DIPOLE IN THE PAST 15,000 YEARS, - - -	<i>Arthur Beiser</i>	235
WESTWARD DRIFT AND CYCLIC SECULAR VARIATION, - - - - -	<i>E. R. Hope</i>	241
DIURNAL VARIATIONS OF SIGNAL LEVEL AND SCATTERING HEIGHTS FOR VHF PROPAGATION, - - - - -	<i>Albert D. Wheelon</i>	255
A LOW-NOISE TRANSISTORIZED SEISMIC PREAMPLIFIER, - - - - -	<i>I. S. Sacks</i>	267
THE THEORY OF MOLECULAR DIFFUSION IN THE ATMOSPHERE, - - - - -	<i>P. Mange</i>	279
THE GEOMETRY OF AURORAL IONIZATION, - - - - -	<i>T. R. Kaiser</i>	297
A METHOD FOR THE DETERMINATION OF THE VERTICAL OZONE DISTRIBUTION FROM A SATELLITE, - - - - -	<i>S. F. Singer and R. C. Wentworth</i>	299
GEOMAGNETIC AND SOLAR DATA: Final Relative Sunspot-Numbers for 1956, <i>M. Waldmeier</i> ; International Data on Magnetic Disturbances, Part 1, Sudden Commencements and Solar-Flare Effects, Third and Fourth Quarters, 1956, <i>A Romañá</i> , and Part 2, <i>K_p</i> , <i>A_p</i> , <i>C_i</i> , and Selected Days, Fourth Quarter, 1956, <i>J. Bartels and J. Veldkamp</i> ; Provisional Sunspot-Numbers for January to March, 1957, <i>M. Waldmeier</i> ; Fredericksburg Three-Hour-Range Indices <i>K</i> for January to March, 1957, <i>Robert L. Gebhardt</i> ; Principal Magnetic Storms, - - - - -		309
LETTERS TO EDITOR: Anomalies on Ionosonde Records Due to Traveling Ionospheric Disturbances, <i>G. H. Munro</i> ; Comments concerning the Kallmann-White-Newell Article, "Physical Properties of the Atmosphere from 90 to 300 Kilometers," <i>Gustavus J. Simmons</i> ; On the Atmospheric Dynamo Theory, <i>Marvin L. White</i> , - - - - -		325
NOTES: World Data Centers for International Geophysical Year; Laboratory of earth sciences established at M. I. T.; A new publication, "Smithsonian Contributions to Astrophysics"; Proceedings of Geophysics Symposium on Solar and Terrestrial Relationships; Centenary of the birth of Heinrich Hertz; U. S. Air Force uses TV for weathervision forecasts; Geomagnetic activities of the United States Coast and Geodetic Survey; Announcement of research positions in the U. S.-IGY Antarctic program; Personalia, - - - - -		331
LIST OF RECENT PUBLICATIONS, - - - - -	<i>W. E. Scott</i>	335

SEPTEMBER, 1957

REFRACTIVE CORRECTIONS TO SCATTER PROPAGATION, - - - - -	<i>Albert D. Wheelon</i>	343
MOLECULAR WEIGHT" OF AIR AT HIGH ALTITUDES, - - - - -	<i>Lewis E. Miller</i>	351
DISCUSSION OF THE BOOKER AND COHEN PAPER, "A THEORY OF LONG-DURATION METEOR ECHOES BASED ON ATMOSPHERIC TURBULENCE WITH EXPERIMENTAL CONFIRMATION,"	<i>L. A. Manning and V. R. Eshleman</i>	367
METHOD FOR OBTAINING LF OBLIQUE-INCIDENCE REFLECTION COEFFICIENTS AND ITS APPLICATION TO 135.6-Kc/s DATA IN THE ALASKAN AREA, - - - - -	<i>John E. Bickel</i>	373
THE RELATION OF FORWARD SCATTERING OF VERY HIGH FREQUENCY RADIO WAVES TO PARTIAL REFLECTION OF MEDIUM FREQUENCY WAVES AT VERTICAL INCIDENCE,	<i>J. B. Gregory</i>	383
LYMAN ALPHA AND X-RAY EMISSIONS DURING A SMALL SOLAR FLARE, <i>T. A. Chubb, H. Friedman, R. W. Kreplin, and J. E. Kupperian, Jr.</i>		389
STUDIES OF TRANSEQUATORIAL IONOSPHERIC PROPAGATION BY THE SCATTER-SOUNDING METHOD, - - - - -	<i>O. G. Villard, Jr., Sidney Stein, and K. C. Yeh</i>	399
TMOSPHERIC DRAG ON THE SATELLITE, - - - - -	<i>R. Jastrow and C. A. Pearse</i>	413
POSSIBLE TROPOSPHERE-IONOSPHERE RELATIONSHIP, - - - - -	<i>Siegfried J. Bauer</i>	425
DISTURBANCES IN THE LOWER IONOSPHERE OBSERVED AT VHF FOLLOWING THE SOLAR FLARE OF 23 FEBRUARY 1956 WITH PARTICULAR REFERENCE TO AURORAL-ZONE ABSORPTION, - - - - -	<i>D. K. Bailey</i>	431
TRESS-INDUCED MAGNETIZATIONS OF SOME ROCKS WITH ANALYZED MAGNETIC MINERALS, <i>John W. Graham, A. F. Buddington, and J. R. Balsley</i>		465
EOMAGNETIC AND SOLAR DATA: International Data on Magnetic Disturbances, First Quarter, 1957, <i>J. Bartels, A. Romañá, and J. Veldkamp</i> ; Provisional Sunspot-Numbers for April to June, 1957, <i>M. Waldmeier</i> ; Fredericksburg Three-Hour-Range Indices <i>K</i> for April to June, 1957, <i>Robert L. Gebhardt</i> ; Principal Magnetic Storms, - - - - -		475
ETTERS TO EDITOR: Field-Strength Variations Recorded on a VHF Ionospheric Scatter Circuit during the Solar Event of February 23, 1956, <i>Hope I. Leighton</i> ; Complete Night of Vertical-Incidence Ionosphere Soundings Concerning Frequency Range from 50 Kc/s to 25 Mc/s, <i>J. M. Watts</i> ; The Figure of the Earth's Core and the Non-Dipole Field, <i>G. D. Garland</i> ; Latitude Effect of Night Airglow, <i>Junji Nakamura</i> ; Solar Activity and Atmospheric Tides, <i>B. Haurwitz, J. London, G. Sepúlveda, and M. Siebert</i> ; On the Geomagnetic Storm Effect, <i>C. O. Hines</i> ; Some Comments on J. S. Chatterjee's "Induction in the Core by Magnetic Storms and Earth's Magnetism," <i>T. Rikitake</i> , - - -		483
NOTES: National Academy of Sciences twelfth meeting of U. S. National Committee for the International Geophysical Year 1957-58; IGY data centers in the United States; Annals of the International Geophysical Years; Establishment of magnetic observatory at Hartland, England; Publication of VLF symposium papers; Measurement of the sun's magnetic field; Recent monthly periodical, "Annals of Physics"; New "Journal of Molecular Spectroscopy"; Geomagnetic activities of the United States Coast and Geodetic Survey; Personalia, - - - - -		495
LIST OF RECENT PUBLICATIONS, - - - - -	<i>W. E. Scott</i>	500

SWEET'S MECHANISM FOR MERGING MAGNETIC FIELDS IN CONDUCTING FLUIDS, <i>E. N. Parker</i>	509
HYDROGEN IN AURORAS, - - - - - <i>C. W. Gartlein and G. Sprague</i>	521
UHF RADAR OBSERVATIONS OF AURORA, <i>S. J. Fricker, R. P. Ingalls, M. L. Stone, and S. C. Wang</i>	527
VHF RADAR ECHOES ASSOCIATED WITH ATMOSPHERIC PHENOMENA, - - - - - <i>G. C. Rumi</i>	547
AN APPRAISAL OF PHOTON COUNTER MEASUREMENTS OF UPPER ATMOSPHERE PARAMETERS, <i>Gustavus J. Simmons</i>	565
MAGNETIC FIELDS IN A CONDUCTING FLUID SPHERE WITH VOLUME CURRENTS, <i>K. P. Chopra</i>	573
THE EFFECT OF SOLAR FLARES ON THE GEOMAGNETIC FIELD, - - - - - <i>R. Pratap</i>	581
SUDDEN COMMENCEMENTS OF MAGNETIC STORMS AND ATMOSPHERIC DYNAMO ACTION, <i>T. Obayashi and J. A. Jacobs</i>	589
AIRBORNE MEASUREMENT OF ATMOSPHERIC POTENTIAL GRADIENT, - - - - - <i>John F. Clark</i>	617
GEOMAGNETIC AND SOLAR DATA: International Data on Magnetic Disturbances, Second Quarter, 1957, <i>A. Romaña, J. Bartels, and J. Veldkamp</i> ; Provisional Sunspot-Numbers for July to September, 1957, <i>M. Waldmeier</i> ; Fredericksburg Three-Hour-Range Indices K for July to September, 1957, <i>Robert L. Gebhardt</i> ; Principal Magnetic Storms,- - - 629	
LETTERS TO EDITOR: Discussion of the Wheelon Paper, "Radio Frequency and Scattering Angle Dependence of Ionospheric Scatter Propagation at VHF," <i>Ralph Bolgiano, Jr.</i> ; Occurrence of Soft Radiation during the Magnetic Storm of 29 August 1957, <i>Kinsey A. Anderson</i> ; Comments on the Villard-Stein-Yeh Paper, "Studies of Transequatorial Ionospheric Propagation by the Scatter-Sounding Method," <i>R. Silberstein</i> , - - - - - 639	
NOTES: Russian satellite launched; World IGY data centers; New IGY Bulletin; Publica- tion of a discussion by the Royal Astronomical Society on the solar burst of February 23, 1956; Publication of papers delivered at Conference on Rock Magnetism; Polish magnetic observatory rebuilt; New officers, Society of Exploration Geophysicists; Record balloon flight; New 1958 journal, "The Physics of Fluids"; Geomagnetic ac- tivities of the United States Coast and Geodetic Survey; Personalia; Corrigendum, - - - 647	
LIST OF RECENT PUBLICATIONS, - - - - - <i>W. E. Scott</i>	650
URSI MEETS IN BOULDER, - - - - -	659